SEASONAL VARIATION IN MOBBING INTENSITY IN THE BLACK-CAPPED CHICKADEE

Douglas H. Shedd

Several studies have indicated that mobbing behavior in some species of birds is most intense during the breeding season (Altmann 1956, Horn 1968, Root 1969, Curio 1975, Shedd 1982). In Shedd (1982), I suggested that in some migratory species, such as the American Robin (*Turdus migratorius*), one might expect mobbing to be absent or less intense outside the breeding season, because at this time birds are not confined to territories, and because they are not defending young. Many species of birds, however, do mob predators outside the breeding season. Here I present information for such a species, the Black-capped Chickadee (*Parus atricapillus*).

METHODS

From 1 June 1974–31 August 1976, field trials were performed on a weekly basis in the vicinity of Ithaca, Tompkins Co., New York. The procedure during these trials simulated a natural mobbing episode. A mounted Eastern Screech-Owl (*Otus asio*) was placed in a conspicuous location 2 m from the ground. A recorded screech-owl call was then played from a speaker located 10 cm from the mounted specimen. All trials were observed from concealed positions 10 m from the mount. To reduce the likelihood of habituation, care was taken not to perform a trial at a study site more frequently than once every 5–7 days. The total number of trials in each month varied; in general, there were fewer total trials during the winter months because bad weather limited access to study sites (Table 1).

Data from the study period were totaled and then treated as a single 12-month series. For each month, the average number of minutes of mobbing per bird (AMM/B) was calculated by summing minutes of mobbing and dividing by the total number of mobbing birds. The percentage of successful trials (trials that resulted in mobbing) and the average number of mobbing birds per successful trial were also calculated for each month.

The equality of monthly means was tested using a single classification ANOVA, with means weighted according to the reciprocal of the variance of the samples from which they were drawn. This adjustment results in an approximate test of equality of means when variances are heterogeneous (Snedecor 1956, Sokal and Rohlf 1969). Further details concerning methods and study areas may be found in Shedd (1982).

RESULTS

Chickadees were abundant during all months of the year in Ithaca and were observed mobbing the mounted owl in each month of the study. The AMM/B index ranged from a maximum of 4.2 min of mobbing/bird in August to a minimum of 1.8 min of mobbing/bird in January ($P < 0.05$, $F = 2.448$). In general, AMM/B values were high from July through September, and then somewhat lower at other times of the year (Table 1).

TABLE 1

PERCENTAGE OF SUCCESSFUL TRIALS, AVERAGE MINUTES OF MOBBING/BIRD (AMM/B),
AND AVERAGE NUMBER OF BIRDS/SUCCESSFUL TRIAL FOR EACH MONTH (ITHACA, NEW
YORK)

Month	Total trials	Successful trials	Total birds	Percentage of successful trials	AMM/B[a]	Average number of birds/ successful trial
January	35	19	67	57.1	1.8	3.5
February	18	5	20	27.8	2.2	4.0
March	37	18	57	48.7	2.9	3.2
April	59	26	79	44.1	2.9	2.9
May	103	39	63	37.9	2.5	1.7
June	134	59	118	44.0	2.8	2.1
July	151	64	222	42.0	4.1	3.5
August	172	77	284	44.8	4.2	3.7
September	91	54	215	59.3	3.7	4.0
October	95	49	172	51.6	2.5	3.6
November	54	19	73	35.2	2.3	3.8
December	29	13	62	44.8	2.0	4.8

[a] Average number of minutes of mobbing per bird.

The percentage of trials successful in producing mobbing varied from a high of 59.3% in September to a low of 27.8% in February (Table 1). The percentage of successful trials did not seem to follow any apparent pattern, but rather averaged about 45% of all trials. Values of 50% or higher were recorded in January, September, and October. Values of 40% or lower were recorded in February, May, and November. The average number of birds mobbing during a successful trial varied from a low of 1.7 in May to a high of 4.8 in December ($P < 0.05$, $F = 6.349$) (Table 1).

In addition to mobbing, chickadees performed three behaviors related to mobbing: silent approach, vocal approach, and attacking (see Shedd 1982). These three behaviors were infrequently observed, however, and no seasonal variation could be detected.

DISCUSSION

The seasonal variation in mobbing intensity displayed by the Black-capped Chickadee is best considered in the context of the annual life cycle of the species. Odum (1941a), working in Rensselerville, Albany Co., New York, found that the first evidence of courtship and pair formation occurred from 10–25 April. Glase (1973), working in Ithaca, New York, found that by the third week in April all dominant males were alone on a territory

with a mate. Glase (1973) gave the mean hatching date in Ithaca as 8 June. Thus, for most of April and May, pairs were on territories, but had no young (note that the average number of birds/successful trial in May was only 1.7). Mobbing intensity during this period was quite low (Table 1).

The relatively low intensity of mobbing at this time may be related to the large size of chickadee territories. In a 2-year study in Utah, Stefanski (1967) found that during the prenesting stage in 1964 territories averaged 1.8 ha, and in 1965 averaged 2.6 ha. Odum (1941a) found that territory size in New York averaged 13.2 acres (5.2 ha). Birds confronted with predators must choose among a variety of predator responses ranging from escape to attack. The balance of risk to gain is the probable factor determining what behavior is displayed. In a situation where pairs without young are living on large territories, it may be that limited mobbing is the most adaptive response to a predator. The fact that females were spending considerable time in incubation during the latter part of May could have also contributed to the low level of mobbing activity in this month.

Odum (1941b) gave a mean fledging date of 23 June and Weise and Meyer (1979) found that families remain together for about 20 days after fledging. Thus, parents could be expected to be on territories with fledged young from late June until mid-July. Odum (1941b) stated that fledging for second broods occurred in late July, so families resulting from second broods would break up in mid- or late August. The AMM/B index peaks during these 2 months (Table 1). This may be the result of the increased vulnerability of the young when they leave a hole-nest at fledging, and of the high parental investment in fledged young (Barash 1975, Gottfried 1979). Also, the post-fledging period would seem to be the time most likely for the cultural transmission of predator recognition and the associated mobbing response if the hypotheses of Curio et al. (1978) and Vieth et al. (1980) are correct. Clearly, the increase in the average number of birds mobbing per successful trial from 2.1 in June to 3.5 in July in part reflects the mobbing performed by recently fledged birds.

Mobbing in chickadees continues after the end of the breeding season. The intensity of mobbing, however, falls from the maximum in July and August to a minimum in December and January (Table 1). This decline in mobbing may be related to the dispersal of young from parental territories to form new flocks. Judging from Weise and Meyer (1979) nonbreeding flocks usually consist of unrelated birds. It may be that intensive post-reproductive mobbing is not adaptive in chickadees, because closely related individuals are not nearby to benefit.

If the above is an accurate assessment of chickadee mobbing, the question remains as to why chickadees continue to mob at all after the breeding season. Some species, such as the American Robin, largely cease mobbing

screech-owls at the end of the breeding season (Shedd 1982). Chickadees differ from robins in at least two ways that may influence mobbing behavior: (1) chickadees (11.2 g) are much smaller than robins (78 g) (Baldwin and Kendeigh 1938); and (2) chickadees are more sedentary than robins.

The small size of adult chickadees in comparison to robins may mean that chickadees are more vulnerable to owl predation than are robins. Thus, chickadees could be expected to respond to owls at all times of the year, while robins respond only during the breeding season, when the more easily captured young are present. The chief argument against this hypothesis comes from a consideration of the diet of the screech-owl, which encompasses species of a variety of sizes, including birds as large as Mourning Doves (*Zenaida macroura*) (Van Camp and Henny 1975). This hypothesis cannot be dismissed, however, without detailed studies on the fall and winter diet of the screech-owl.

Chickadees and robins both maintain breeding territories. Robins, however, form migratory or nomadic flocks following the breeding season, while chickadees live on winter home ranges in relatively stable flocks consisting of both resident and migrant birds (Odum 1941a, Glase 1973, Mueller 1973, Shedd 1982). Curio (1978) suggested, as part of his "move on" hypothesis of the function of mobbing, Sherman's (1977) idea that more sedentary animals should mob more intensely than less sedentary ones. Living continuously on a territory or home range may mean that mobbing to force a predator away is adaptive at all times of the year, because relocation to avoid further predator encounters is not possible. Thus, for sedentary species, the benefits of causing a predator to "move on" would maintain mobbing at some baseline level that would be increased during the breeding season, as mobbing serves the additional function of protection of the young.

Comparisons of species such as the Black-capped Chickadee and the American Robin indicate the extent to which mobbing can vary from species to species in response to different selection pressures. Mobbing may also vary from individual to individual, and from situation to situation (Shalter 1978). Considerable work remains before a comprehensive explanation of the function and mechanics of this behavior is possible.

SUMMARY

Black-capped Chickadees (*Parus atricapillus*) were found to mob an Eastern Screech-Owl (*Otus asio*) at all times of the year. Mobbing was most intense during July and August and least intense during December and January. I suggest that, since chickadees alternate between breeding territories and home ranges, mobbing to force a predator away is adaptive throughout the year. For species that are largely sedentary, the benefits of causing a predator

to move to another location may maintain mobbing at some baseline level that would be increased during the breeding season, as mobbing serves the additional function of protection of the young.

ACKNOWLEDGMENTS

LITERATURE CITED

ALTMANN, S. A. 1956. Avian mobbing behavior and predator recognition. Condor 58:241–253.

BALDWIN, S. P. AND S. C. KENDEIGH. 1938. Variation in weight of birds. Auk 55:416–467.

BARASH, D. P. 1975. Evolutionary aspects of parental behavior: distraction behavior of the Alpine Accentor. Wilson Bull. 87:367–372.

CURIO, E. 1975. The functional organization of antipredator behavior in the Pied Flycatcher: a study of avian visual perception. Anim. Behav. 23:1–115.

———. 1978. The adaptive significance of avian mobbing. I. Teleonomic hypotheses and predictions. Z. Tierpsychol. 47:175–183.

———, U. ERNST, AND W. VIETH. 1978. The adaptive significance of avian mobbing. II. Cultural transmission of enemy recognition in blackbirds: effectiveness and some conclusions. Z. Tierpsychol. 48:184–202.

GLASE, J. C. 1973. Ecology of social organization in the Black-capped Chickadee. Living Bird 12:235–267.

GOTTFRIED, B. M. 1979. Anti-predator aggression in birds nesting in old field habitats: an experimental analysis. Condor 81:251–257.

HORN, H. S. 1968. The adaptive significance of colonial nesting in Brewer's Blackbirds (*Euphagus cyanocephalus*). Ecology 49:682–694.

MUELLER, E. 1973. Chickadees at adjacent feeding sites: the effects of food deprivation. Auk 90:520–532.

ODUM, E. P. 1941a. Annual cycle of the Black-capped Chickadee—1. Auk 58:314–333.

———. 1941b. Annual cycle of the Black-capped Chickadee—2. Auk 58:518–535.

ROOT, R. 1969. The behavior and reproductive success of the Blue-gray Gnatcatcher. Condor 71:16–31.

SHALTER, M. D. 1978. Effect of spatial context on the mobbing reaction of Pied Flycatchers to a predator model. Anim. Behav. 26:1219–1221.

SHEDD, D. H. 1982. Seasonal variation and function of mobbing and related antipredator behaviors of the American Robin (*Turdus migratorius*). Auk 99:342–346.

SHERMAN, P. W. 1977. Nepotism and the evolution of alarm calls. Science 197:1246–1253.

SNEDECOR, G. W. 1956. Statistical methods. Iowa State College Press, Ames, Iowa.

SOKAL, R. R. AND F. J. ROHLF. 1969. Biometry. W. H. Freeman, San Francisco, California.

STEFANSKI, R. A. 1967. Utilization of breeding territory in the Black-capped Chickadee. Condor 69:259–267.

VAN CAMP, L. F. AND C. J. HENNY. 1975. The Screech Owl: its life history and population ecology in northern Ohio. N. Am. Fauna No. 71.

VIETH, W., E. CURIO, AND U. ERNST. 1980. The adaptive significance of avian mobbing.

III. Cultural transmission of enemy recognition in blackbirds: cross-species tutoring and properties of learning. Anim. Behav. 28:1217–1229.

WEISE, C. M. AND J. R. MEYER. 1979. Juvenile dispersal and development of site-fidelity in the Black-capped Chickadee. Auk 96:40–55.

SECTION OF ECOLOGY AND SYSTEMATICS, CORNELL UNIV., ITHACA, NEW YORK 14850. (PRESENT ADDRESS: DEPT. BIOLOGY, RANDOLPH-MACON WOMAN'S COLLEGE, LYNCHBURG, VIRGINIA 24503.) ACCEPTED 25 JAN. 1983.

WILSON SOCIETY STUDENT MEMBERSHIP AWARD

THE WILSON ORNITHOLOGICAL SOCIETY is offering an annual membership in the Society to undergraduate and graduate students with a continuing interest in ornithology and who would benefit from their association with our Society. Applications can be obtained from John L. Zimmerman, Div. Biology, Kansas State University, Manhattan, KS 66506. Closing date for receiving completed applications is 15 December 1983.